PB-214 119

Developing a Local and Regional Solid Waste Management Plan

Environmental Protection Agency

1972

Distributed By:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

PB 214 119

DEVELOPING A LOCAL AND REGIONAL SOLID WASTE MANAGEMENT PLAN

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. Department of Commerce
Springfield, VA 22151

U.S. ENVIRONMENTAL PROTECTION AGENCY

100
R

DEVELOPING A LOCAL AND REGIONAL SOLID WASTE MANAGEMENT PLAN

A Division of Technical Operations
Open-File Report (TO 14.0)

written by
RICHARD O. TOFTNER, Urban Planner

U.S. ENVIRONMENTAL PROTECTION AGENCY
1972

FOREWORD

This document (TO 14.0) describes the basic features of the planning process and their utilization in the development of a local or regional plan for solid waste management. Purpose of the publication is to aid local and regional agencies in preparing comprehensive solid waste management plans. Intended for solid waste planning use by local or regional operating and planning agencies, the publication's specific applicability to any one unique situation is not necessarily assured; the publication is intended to be flexible enough, however, to serve every agency in accordance with its own needs and special conditions.

Developing local or regional plans for solid waste management should achieve the following objectives: (1) adoption of a sound planning process; (2) establishment of a management system to implement optimum proposals for storage, collection, transportation, disposal, processing, and resource recovery; (3) application to solid waste management of techniques and knowledge from the best of organizational theory, financial management, cost control, and the management sciences in general; (4) furtherance of intergovernmental coordination; (5) integration of the solid waste plan with comprehensive areawide plans; (6) development of sound action programs with the greatest promise for ultimate solution of solid waste problems, conservation of resources, and protection of the environment.

--RICHARD D. VAUGHAN
Deputy Assistant Administrator
for Solid Waste Management

CONTENTS

PART ONE

Page

The Planning Process.....1
- Definition.....1
- Application.....2
- Coordination.....3
- Basic Planning Model.....4
- Initial Planning.....6
- Problem Redefinition.....6
- Objectives and Consideration of Alternative Actions.....6
- Emerging Alternatives and Decisions.....7
- Plan Establishment.....8

PART TWO

Base Studies.....10
- Land Use.....12
- Population.....19
- Economics.....20
- Governmental Structure.....20
- Laws and Ordinances.....21
- Public Facilities and Services.....22
- Physical Conditions (Man-made and Natural).....23
- Transportation.....23
- Current Solid Waste Practices.....25
- References.....30

Preceding page blank

PART THREE

Page

Management Considerations.....32

Organization.....34

Financial Planning.....41

Manpower Planning.....42

Industrial Relations.....46

Public Relations.....48

Advisory Committees.....48

Property and Equipment Management.....49

Control and Evaluation.....52

References.....55

PART FOUR

Management Techniques.....57

Program Evaluation and Review Technique and Critical Path Method (PERT/CPM).....58

Planning-Programming-Budgeting System (PPBS).....58

Linear Programming.....59

Queuing Theory.....60

Management Information Systems (MIS).....61

References.....64

PART FIVE

Implementation.....65

References.....73

PART SIX

Page

Plan Report Preparation.....74
Summary (Section II).....74
Background of the Planning Area and Existing Conditions (Sections II and IV).....75
Future Conditions (Projections, Section V).....76
Objectives (Section VI).....77
Recommendations for Action (Section VII).....82
Implementation (Section VIII).....85

Plan Report Outline.....86
Brief Guide.....86

General References.....92

FIGURES

Page

1. Basic Planning Model.....5
2. Workform (Land Use Category: Residential).....16
3. Workform (Land Use Category: Commercial).....17
4. Workform (Land Use Category: Industrial).....18
5. Sample Form for Jurisdictional Planning Profile...29
6. Workform (Solid Waste Management Organization - Age Groups).....44
7. Workform (Solid Waste Management Organization - Manpower Losses).....45
8. Workform (Capital Acquisitions Schedule).....51
9. Sample Form to Forecast Requirements for Sanitary Landfill Acreage.....78
10. Sample Working Form to Develop Objectives.....83
11. Sample Planning Workform for Plan Development.....84

DEVELOPING A LOCAL AND REGIONAL SOLID WASTE MANAGEMENT PLAN

PART ONE: THE PLANNING PROCESS

Definition

Planning is the conscious process for achieving future objectives with rational and full consideration of any likely contingencies and alternatives. A plan should guide intended action specifying the time and priorities for accomplishing this intended action. The planning process is a systematic method of: (1) recognizing that a general situation or problem exists; (2) collecting and analyzing data about this general situation or problem; (3) redefining the situation or problem in light of the analyzed data; (4) establishing objectives, the accomplishment of which will serve to change the situation or correct the problem; (5) predetermining methods, timing, and priorities for achieving objectives; (6) evaluation of the predetermined methods in light of their success or failure in achieving objectives and modification of the plan to meet changing conditions.

In requiring a systematic approach for achieving objectives, planning for solid waste management at the State, regional, and local levels is similar to planning for any activity. Although a plan can and should be

revised while underway to accommodate changing situations, it should be formalized for continuing reference. Local and regional plans are intended for carrying out direct operations of a solid waste management system or to provide the basis for design of solid waste facilities. State solid waste plans on the other hand, are for providing the broad framework of policies, regulations, standards, and criteria by which local and regional planning can be accomplished.

A local or regional plan for solid waste management, therefore, should be a written document outlining the activities that the agency intends to undertake during the life-span of the plan. Moreover, it should be both a technical and policy statement containing objectives for solution of solid waste management problems, coupled with a set of directions for achieving those objectives. This statement should then be framed within a time context and order of priorities.

Application

The local or regional plan for solid waste management should adequately serve five functions: (1) provide an internal technical and policy guideline for carrying out the purposes of the local or regional solid waste management agency; (2) provide a public-directed framework of standards for local and regional solid waste management planning and implementation; (3) provide for an integrated

management system of approved storage, collection, transportation, possible resource recovery and final disposition of solid waste through either direct operations, regulated performance, or a combination of both; (4) establish methods and procedures for translating the plan into system design and direct operations; (5) serve as a legislative support document for furthering the improved management of solid wastes within the jurisdiction.

Coordination

The essence of planning is coordination. Planning requires resolution of conflicting interests, allocation of available funds and other resources, intergovernmental and interdepartmental cooperation, and establishment of priorities. From the standpoint of the direction and overall needs of local or regional government, a solid waste management plan is one among several functional plans, such as those dealing with streets, sewer and water, education, health, public safety, and recreation. Local and regional solid waste management plans, therefore, should relate to, and not conflict with other plans of the jurisdiction. It is also essential that State regulations and required performance standards and other provisions be considered in planning at the local and regional level. Particularly important in solid waste planning is coordination with the

private sector which provides much of the solid waste services in many areas. The public must insure that it will receive a high level of total service at a reasonable cost from the private operator.

Basic Planning Model

The procedure for developing a local or regional plan for solid waste management can be explained by structuring the various steps normally taken in formulation of a plan and can be shown in a simple 8-step model (Figure 1). The planning process is not static, as it may appear in the diagram, but dynamic and continuous. The various steps in the planning process should also be considered as capable of occurring simultaneously although in preparing the written plan report some jurisdictions may prefer to consider each phase in sequence. Each step could, in fact, serve as a separate chapter or section of a plan report. A planning model should provide feedback into the system from various planning process events as these occur (Figure 1). The model itself has built-in controls to allow for correction of errors discovered through feedback relationships. Developments outside the planning process also cause corrections or revisions. Social, legal, and environmental changes can affect the plan and need to be considered.

BASIC PLANNING MODEL *

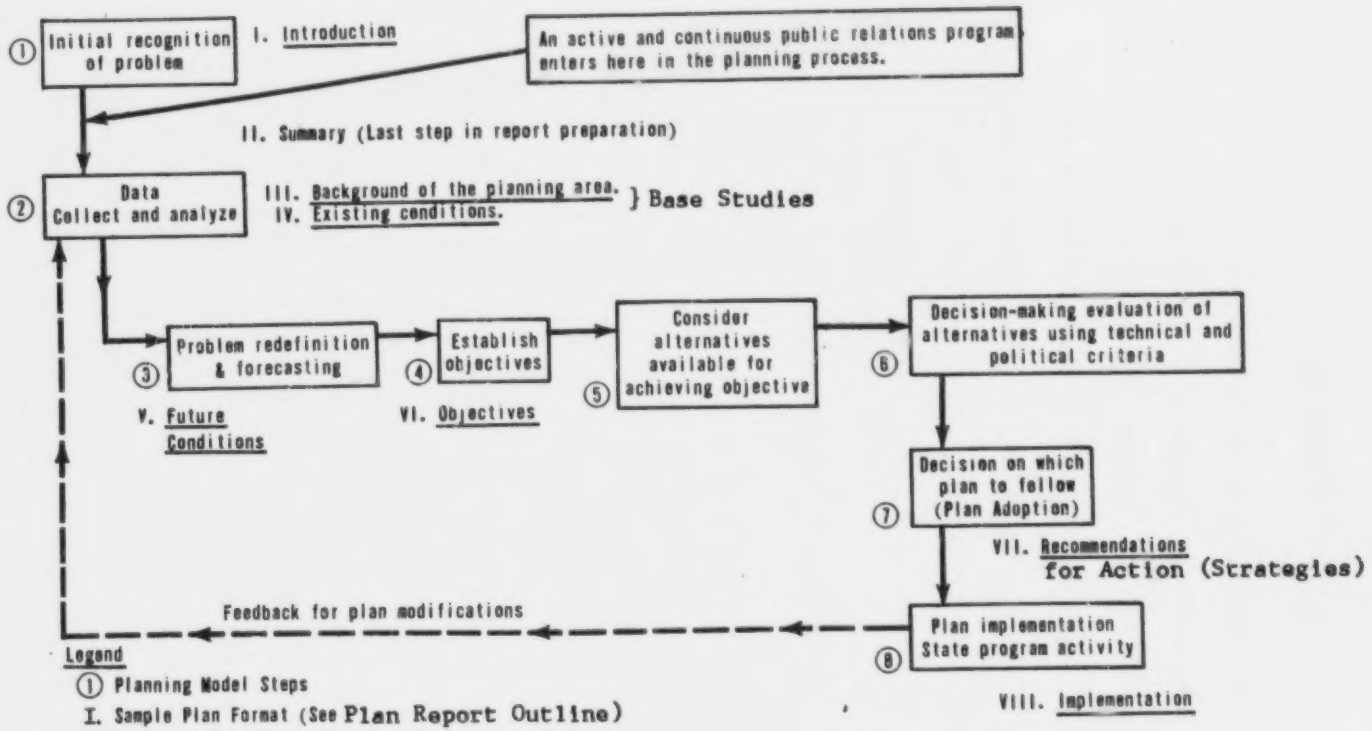
① Initial recognition of problem
I. Introduction
An active and continuous public relations program enters here in the planning process.
II. Summary (Last step in report preparation)
② Data Collect and analyze
III. Background of the planning area.
IV. Existing conditions.
} Base Studies
③ Problem redefinition & forecasting
V. Future Conditions
④ Establish objectives
VI. Objectives
⑤ Consider alternatives available for achieving objective
⑥ Decision-making evaluation of alternatives using technical and political criteria
⑦ Decision on which plan to follow (Plan Adoption)
VII. Recommendations for Action (Strategies)
⑧ Plan implementation State program activity
VIII. Implementation
Feedback for plan modifications
Legend
① Planning Model Steps
I. Sample Plan Format (See Plan Report Outline)

Figure 1. The first step (1) in the planning process is awareness that a problem exists and needs to be solved. The second step (2) is to collect and analyze data relating to the problem. Such analysis makes possible a redefinition of the problem and a forecasting of future situations (3). Problem definition for both the present and future situation helps to suggest objectives (4) that if achieved would serve to solve the problems. Two or more alternatives (5) might be available for solving the problem and achieving objectives. The feasible alternative or alternatives (6) are selected by considering technical, political, social and other factors. Once this decision has been made a plan for solution of the problems (7) can be adopted. Actual action for carrying out the plan (8) then follows. Effectiveness of the plan is measured during its implementation. This data is fed back into the continuing planning process to guide plan modifications if needed.

*Adapted from: Developing A State Solid Waste Management Plan. (R.O. Toftner) Public Health Service Publication No. 2031. Washington, U.S. Government Printing Office, 1970.

Initial Planning

Awareness or recognition of a situation is the first step in the planning process and is the catalyst that results in the second action: data collection and analysis. The data and their analysis will provide the basic facts without which planning is impossible. Analysis of data will also point up problem areas and situations requiring consideration in the plan (Figure 1, steps 1 and 2).

Problem Redefinition

Ad indicated by analysis of the data the next step is redefinition of the problem and identification of such problems and conditions that will be relevant in the future. This requires forecasting (Figure 1, step 3).

Objectives and Consideration of Alternative Actions

Enough is now known about the problem that specific objectives may be set and alternate methods for achieving these may be suggested (Figure 1, steps 3 and 4). The local or regional solid waste management agency is saying: "What situation should be changed and which problems corrected?" "Where should modifications be made?" Several alternatives might be available to achieve objectives.

Emerging Alternatives and Decisions

Which alternative or alternatives should the local or regional agency select to accomplish the objectives set forth to solve its solid waste management problems? The answer to this question will help establish the program priorities. These decisions are subject to all sorts of influences that must be considered when developing the local or regional solid waste management plan (Figure 1, steps 5 and 6). Such influences may be both constraints and resources and include political, legal, social, and financial factors, and available technology. Basic among these are political and technical influences. Because of the technical nature of the decisions, a specialized interdisciplinary staff, the one that has been developing the plan to this point, should continue to play a role in supplying information and expert evaluation of alternative solutions and in implementing the plan. Evaluation of existing State, regional, or local plans is an important part of this step. Solid waste management plans should be compatible with existing plans, assuming such plans take solid waste needs into account. Therefore, decision-making for the solid waste management plan will be based to some extent upon political exigencies, specialized technical analysis, and existing plans.

Those alternative solutions which appear feasible on the basis of such consideration should be submitted to the

appointed and elected public officials and the public itself for review and possible adoption, but not without adequate preparation for such a step. This means a program of education of officials and the public--a vital and integral part of the entire planning process. The agency conducting the planning should have initiated an information and education program early in the plan formulation stages, and the public information plan should continue through implementation of the entire plan. News releases, films, articles, and speakers, for example, can help promote public awareness and aid in approval of solid waste management plans and programs.

Plan Establishment

Once the decision-making stage has been completed, decisions should be translated into the recommended strategies and priorities that form the core of the plan (Figure 1, step 7). Although, at this point, a local or regional plan for solid waste management has emerged, the planning process has not been completed. Planning will be continuous and proceed concurrently with implementation of previously planned proposals (Figure 1, step 8). Original plans will need reevaluation and modification to accommodate changing situations. Earlier forecasts will require revision. This

evaluation and modification will provide new information and along with the results of implementing the plan will be fed back into the planning process, as indicated in the model.

PART TWO: BASE STUDIES

Just as the term implies, the purpose of base studies is to form a foundation and data base upon which to support succeeding analyses and recommendations. Base studies help to construct a logical framework within which rational planning can occur. Problems and limitations are identified, and available resources inventoried.

In planning for local and regional solid waste management systems certain essential basic information must be assembled and analyzed. Minimum requirements will usually include data about population, economics, land use, governmental jurisdiction and structure, physical conditions, legal framework, public facilities and services which compete with or complement solid waste management, transportation corridors and modes available, current solid waste practices, and solid waste collection and generation rates.

Much of this data is available from secondary sources thus eliminating the requirement of a primary survey. If these sources are known much time can be saved in collection and analyses. About one-fifth of the needed data can be derived from the Office of Solid Waste Management Programs' National Survey of Community Practices. Additional data is available from state solid waste agencies. Other state agencies, such as departments of planning, natural resources, and highways can often provide abundant information. On the

local level, city, county, and regional planning departments are usually the best sources of data for solid waste planning. Indeed, solid waste planning will often be conducted by these agencies or should be closely coordinated with them. Banks and chambers of commerce can provide useful information as well. The U.S. Bureau of the Census is an important source of information about population and the economy.

Some primary data collection will no doubt be necessary. For example, data about solid waste generation loads and accurate breakdowns of solid waste components are not generally available. In this case a survey sample must be taken with suitable planning figures established through weighing and separating. In addition, surveys and examination must be made of collection practices and equipment, transfer stations, disposal sites and incinerators. Often accurate financial base data needed for planning is also lacking. Establishment of useful figures about operational or capital costs will require a careful analysis of aggregate data to derive those figures pertaining only to solid waste management. Sometimes fairly accurate estimates can be established by tracing a path through the system and costing out critical components. Departments of public works or sanitation can be extremely helpful in this regard since these agencies are usually the solid waste management operating agency.

Land Use

Land use considerations are at the core of local and regional comprehensive plans. Planning for land use is a prerequisite for community plans concerned with transportation, housing, and the full range of public facilities and services. Local and regional land use planning focuses on better arrangements and uses of land in accordance with economy, public interest, convenience, health and safety, and amenity. Land use planning is especially critical to solid waste management problems. Land is needed for transfer, disposal, reduction, and resource recovery facilities. Usually land needed for these purposes must compete with other land needs. More importantly, however, public acceptance of solid waste purposes and needs must be gained. Usually reservation or acquisition of land for solid waste purposes is thwarted by public opposition. This opposition can reveal itself by angry protests at public hearings or in newspapers, political pressures, and even formalized by local ordinance. For example, solid waste land uses are often omitted as a permitted use in zoning ordinances or else specifically prohibited. If land is made available it is often unsuitable because of soil, geology, topography, water pollution potential, inadequate protection to natural resources or so isolated from the service area as to be uneconomical.

Good land use planning for solid waste management requires consideration of air, water, and land pollution potential, transportation, economic location, population, relationship to overall community plans, and ultimate use of the land. In considering these elements for land use planning, solid waste must be viewed in three basic stages--generation point, transportation, and final disposition.

For urban generation, solid waste should be identified according to residential, commercial, and industrial land uses. If the community has a comprehensive planning program a land use survey has usually been completed with data recorded and mapped. This land use inventory should serve as the basis for relating solid waste generation to specific land uses. For example, a part of the existing land use will likely be residential. The individuals in these residences generate a certain amount of solid waste. By dividing the total residential acreage into the total solid waste generated by residents living on that acreage, for a given time period, the generation rate could be derived. Assuming a generation rate containing a growth factor and examining projected figures and plans for land use, a fairly realistic estimate of expected solid waste generation could be developed for existing and future residential areas. This approach has the advantage of yielding total figures for solid waste generation, as well as the location or nodes

of generation. Zoning is also an indicator of the potential solid waste load on the system and as a means of providing an estimate of spatial distribution. Further refinement of land use-solid waste generation is possible which could permit more precise planning where needed. For example, residential land use might be subdivided into single and multi-family dwellings. Commercial land uses could be further defined as to retail categories, such as drug, food, hardware, and general merchandise outlets. Solid waste generation might then be related to sales volume and selling floor square footage of the store. This would provide a solid waste generation predictor for commercial land uses in other areas having similar characteristics. Industrial land uses might be further classified according to the Standard Industrial Code (SIC) categories, such as meat packing, electrical housewares, and motor vehicle production. This would facilitate determination of characteristics of wastes from plants bearing certain SIC designations. Amounts of solid waste could be predicted from a determination of product units produced in the plant.

Precise locations (generation nodes) and amounts of solid waste (generation) can then be readily used as variables in a linear program allocation model for optimal assignment to transfer stations, disposal and reduction facilities, and resource recovery yards. This allocation procedure is explained in Part Four, (Management Techniques), section of this document.

Depending upon the size area being planned and complexity of the data, this procedure can be adapted to either computer or manual methods. In planning for solid waste management in large, highly complex areas computer methods for data handling, optimal routing and allocation, and map plotting might be necessary.

Following are workforms (Figures 2, 3, & 4) presented as examples for data array and computation for the three major land use categories along with suggested breakdowns for more precise planning. Sub-Categories selected should be appropriate to each major sub-planning area.

WORKFORM

Sheet 1 of ____ Major Planning Area _____

Land Use Category: Residential Sub Planning Area _____

Sub Category	Acreage	Population	Waste Characteristics* (% each)	Reclamation Components (% each)	Waste Generation (Tons)	
					Daily	Annual
Single-Family						
Two-Family						
Multi-Family						
1-Floor						
2-Floors						
3-10 Floors						
Over 10 Floors						
Institutional						
Hospital						
School						
Religious						
Correctional						
				Total		

*Waste Characteristics: A-Metal; B-Paper; C-Wood; D-Plastics; E-Food; F-Chemical; G-Petroleum; H-Radioactive; I-Pathological; J-Glass

Figure 2

WORKFORM

Sheet 1 of ____ Major Planning Area _____

Land Use Category: Commercial Sub Planning Area _____

Sub Category	Selling Floor Area (sq. ft.)	Sales ($000)	Waste Characteristics* (% each)	Reclamation Components (% each)	Waste Generation (Tons)	
					Daily	Annual
Lumber, Hardware, Farm Equipment						
General Merchandise						
Food						
Automotive						
Gas Service Stations						
Furniture & Home Furnishings						
Apparel, Accessories						
Eating & Drinking Places						
Drug Stores						
Other Retail						
Offices						
				Total		

*Waste Characteristics: A-Metal; B-Paper; C-Wood; D-Plastics; E-Food; F-Chemical; G-Petroleum; H-Radioactive; I-Pathological; J-Glass

Note: U.S. Census of Business Classifications should be used for Sub Categories whenever possible.

Figure 3

WORKFORM

Sheet 1 of ____

Major Planning Area _____

Land Use Category: Industrial

Sub Planning Area _____

Sub Category (Standard Industrial Classification) SIC	Activity	Units of Production	Waste Characteristics* (% each)	Reclamation Components (% each)	Waste Generation (Tons) Daily	Annual
2011	Meat Packing					
2037	Frozen Fruits, Juices and Vegetables					
2522	Metal Office Furniture					
2621	Paper Mills					
2653	Corrugated and Solid Fiber Boxes					
2818	Organic Chemicals					
3079	Plastic Products					
3334	Primary Aluminum					
3634	Electrical Housewares and Fans					
3651	Radio and Television Receiving Sets					
3711	Motor Vehicles and Parts					
3721	Aircraft					
				Total		

*Waste Characteristics: A-Metal; B-Paper; C-Wood; D-Plastics; E-Food; F-Chemical; G-Petroleum; H-Radioactive; I-Pathological; J-Glass

Figure 4

Transportation and final disposition of solid waste will depend upon generation locations, types of solid waste, and availability of sites for transfer stations, resource recovery yards, sanitary landfills, and incinerators. These considerations must be included in planning the total system. Care should be taken to plan sites in accordance with the area's comprehensive plan. Indeed, sites for solid waste management should become an integral part of the comprehensive plan.

Population

Determination of past, current, and future population of a jurisdiction is an important planning consideration. When related to solid waste generation rates, land uses, employment centers, and other data, population information can help determine sources of solid wastes, equipment needs, capacities and locations of reduction and disposal facilities. Aspects of population which should be considered include: total size (past, current, future), family size, age distribution, densities (by either planning area, enumeration district, or census tract), and growth rates.

A good deal of population data will be available in tabulated and analyzed form from local and state planning agencies, economic development agencies, and chambers of

commerce. If the data are not available from these sources, U.S. Census publications contain considerable population data which, however, will require organization and analysis.

Economics

Knowledge about the economy of a jurisdiction will provide valuable insights about the existing and future generators of solid wastes, competition for public funds, and the ability of the jurisdiction to provide increasing revenues as demands for expenditures grow. Factors that should be examined include: industrial composition, employment groups, family income, retail trade, trade area, number of retail establishments, import-export (local and regional), tax base (assessed valuation), tax rates, and debt limitations and capacities.

Much of this data will be available from local and state planning agencies, economic development agencies, chambers of commerce, banks, universities, and U.S. Bureau of the Census in report form and complete with analysis. In some cases further collection and analysis of economic data will be required. Other raw data is often available from the same agencies.

Governmental Structure

In order to determine adequacy or propose alternative more adequate jurisdictional organization structures for

solid waste management in the plan an understanding of existing governmental structure should be developed. If the planning area is regional in scope several individual jurisdictions may be involved making the problem more complex.

Especially relevant will be the names, official boundaries, and powers and responsibilities of these jurisdictions. Functional relationships to solid waste management should be noted. During plan development close coordination must be maintained with all governmental units included in the planning area.

Laws and Ordinances

Plans for solid waste management will affect and be affected by state laws and local ordinances. Therefore, cognizance of existing laws and ordinances must be made. An inventory of all laws and ordinances pertinent to solid waste management should be assembled during the basic data collection stage of planning. Particularly relevant to solid waste management are laws and ordinances dealing with public health, zoning, subdivision regulation, building codes, public finance, intergovernmental agreements, air and water pollution, planning, and, of course, those dealing specifically with solid waste.

A complete inventory of laws and ordinances will provide the legal framework for planning. Furthermore,

the inventory will provide the basis for new laws and ordinances or amendments where existing laws are inadequate.

Public Facilities and Services

Consideration should be given to various public facilities and services in the planning area. Often solid waste management will compete for funds and other resources with these activities. It will frequently be found that solid waste management is a function carried on by these other activities. This is particularly true of public works and street departments. In some cases these facilities and services can complement solid waste management. For example, existing utilities might be restructured to include solid waste management. Central garages and yards might be used for transfer station sites or resource recovery stations.

During the basic studies survey information should be developed to show the relationship between solid waste management and the following public facilities and services:

Governmental centers
Public works
Water and sewer
Service utilities
Health facilities
Schools
Central garages and yards
Shipping terminals

Physical Conditions (Man-made and Natural)

In locational analysis for determining actual or potential solid waste reduction and disposal sites, consideration should be given to physical and natural conditions to assess suitability for solid waste management and to provide adequate environmental protection. Some data which should be collected and analyzed include: topographic features; general soils; groundwater, flood areas; oil, gas, and coal resources; clay, shale, and rock deposits; timber; and local climatology.

If these data are not already available from local, regional, or State planning agencies the following sources can in most cases provide the information: U.S. Geological Survey, U.S. Department of Agriculture, National Weather Service (NOAA), universities, state geological survey, and state natural resources departments.

Transportation

A vital part of a local or regional solid waste management plan must be consideration of transportation. Solid waste cannot be moved for disposal or resource recovery without using one or more modes of transportation. The single most important and common mode is a street or highway. Other transportation modes are important to solid waste management also and should not be ignored. For example,

rail and barge routes offer possible means of hauling solid waste for disposal or reclaimed materials for recycling.

A local or regional solid waste management plan should include an inventory of transportation facilities. This information should be evaluated in terms of its present and future application to collection routing, hauls to transfer stations, disposal and reduction facilities, and resource recovery stations. Transportation facilities contained in local or regional comprehensive plans should be related to future solid waste management needs. Examples of transportation information which should be collected and analyzed follow:

a) Streets
   1. Primary
   2. Collector
   3. Local

b) Highways
   1. Freeway and expressway
   2. Primary
   3. Collector

Specialized information regarding streets and highways might be useful in some instances. This might include:

Travel-way width

Number of traffic lanes

Surface type

Section length

Present average daily traffic (ADT)

Future ADT

Peak hour % of ADT

Operating speed

Load limits (Some vary with season)

c) Railroads

1. Long-line
2. Short-line
3. Yards

d) Bargeways

1. Canals
2. Rivers
3. Locks

e) Terminals

1. Truck
2. Rail
3. Barge

Current Solid Waste Practices

Collection and analysis of data about current solid waste practices will require care and diligence. Accurate and sufficient solid waste data is generally not available. Yet a solid waste plan cannot be developed without this data. About one-fifth of the required data can be derived from the Office of Solid Waste Management Programs' National

Survey of Community Practices. A review of the document reporting the Survey data is important. The remaining specific solid waste data needed will require surveys although well-taken samples will often suffice.

Generally, current data needed in addition to that described earlier in Part Two, Base Studies, will be concerned with the specifics of storage, collection, transportation, transfer, disposal, reduction, resource recovery, and various organizational management aspects. Examples of planning considerations and the kinds of data needed follow:

1) Existing Methods of:
   Storage
   Collection (type, frequency, quality)
   Transportation (including transfer)
   Disposal and/or reduction
   Resource recovery and recycling

2) Waste Generation:
   (Refer also to the Land Use base studies for related data)
   Location (Tons generated and collected)
      Political subdivisions
      Major planning area
      Sub planning area

Amounts (Tons generated and collected)

Residential

Commercial

Industrial

Other

Types (Classify by components)

Residential

Commercial

Industrial

Other

3) Equipment and Property:

Trucks (types, capacities, life)

Transfer stations (locations, type, capacities, life)

Land disposal (locations, types, capacities, life)

Incinerators (locations, types, capacities, life)

Resource recovery stations (locations, capacities, equipment, life)

4) Management Problems:

(Refer also to Part Three, Management Considerations)

Overall evaluation

Environmental effects (air, water, population densities, noise)

Finance (capital, operating, fees, records)

Organization

Manpower

Industrial relations

Private/public systems (areas of responsibility)

Contractual arrangements

Regulation/enforcement

Public relations

A complete analysis of the current and future effects of these data should be made.

In developing local or regional plans it might be helpful to organize a jurisdictional planning profile. The workform (Figure 5) will aid in organizing the basic problem-objective-action procedure for solid waste planning at the local or regional level. Although all of the considerations for planning are not provided on this form, by using it the findings in the base study evaluations will be more clearly focused and related to action solutions.

SAMPLE FORM FOR JURISDICTIONAL PLANNING PROFILE

(1) Planning Jurisdiction _____

(2) Name of Community(ies) Affected _____

(3) Region of State _____

(4) Relevant Community Data (derived from specific data printout for the community from the National Survey of Community Solid Waste Practices)

(5) Significant Problems

a. types

b. locations

c. extent and persistence

d. control difficulties

(6) Future Significance of Problems

(7) Objectives for Action

(8) Specific Recommendations for Action (Strategies)

a. facilities that will be provided

b. timing and priorities

c. location

d. responsibility

e. estimated costs--operating and capital

f. problems that will be solved

Figure 5. Although not providing indication of all jurisdictional planning considerations, this form does help organize solid waste aspects into the problem-objective-action procedure familiar to users of this guideline.

PART TWO: REFERENCES

American Public Works Association. Municipal refuse disposal. 3d ed. Chicago, Public Administration Service, 1970. 538 p.

American Public Works Association. Refuse collection practice. 3d ed. Chicago, Public Administration Service, 1966. 525 p.

Chapin, F. Urban land use planning. 2d ed. Urbana, Ill., University of Illinois Press, 1965. 498 p.

Clark, R.M., and R.O. Toftner. Land use generation in solid waste management. (Being prepared for submission to Public Works).

Cummins, R.L. Effects of land disposal of solid wastes on water quality. {Cincinnati}, U.S. Department of Health, Education, and Welfare, 1968. 29 p.

Davis, P.C. and R.J. Black. Effects of garbage grinding on sewage systems and environmental sanitation. APWA Reporter, 29(12):16-18, Dec. 1962.

Hickman, H.L., Jr. Characteristics of municipal solid wastes. Scrap Age, 26(2):305-307, Feb. 1969.

Hickman, H.L., Jr. Planning comprehensive solid waste management systems. Journal of the Sanitary Engineering Division, Proc. ASCE, 94(SA6):1147-1152, Dec. 1968.

International City Managers' Association. Principles and practice of urban planning. Chicago, 1968. 621 p.

Muhich, A.J., A.J. Klee, and C.R. Hampel. 1968 National survey of community solid waste practices. Public Health Service Publication No. 1866. Washington, U.S. Government Printing Office, 1968. 53 p.

Toftner, R.O. Developing a state solid waste management plan. Public Health Service Publication No. 2031. Washington, U.S. Government Printing Office, 1970. 50 p.

Vaughan, R.D. Recycling and reuse of waste materials; an essential feature of solid waste control systems for the future. Waste Age, 1(1):6-8, Sept. 1969.

Vaughan, R.D. Solid wastes and air pollution. {Cincinnati}, U.S. Department of Health, Education, and Welfare, 1969. 16 p.

PART THREE: MANAGEMENT CONSIDERATIONS

A solid waste management plan would be incomplete and largely inadequate without provisions for operational activities. The operational element of the plan should provide for operational proposals and programs, including administration, organization, finance and budgeting, manpower, industrial relations, public relations and public input, equipment and facilities management, and control and evaluation.

An adequate and viable organization is essential for an effective and efficient solid waste management system. Inadequate organization has been at the root of poor solid waste management; therefore this aspect of planning cannot be over-emphasized. The relationship of both the public and private sectors in solid waste management requires special consideration since each have important responsibilities. Manpower, a significant part of solid waste management systems must be considered carefully. Manpower planning must include long-term staffing forecasts, recruitment methods, training elements and procedures, occupational health and safety standards, collective bargaining, and grievance and arbitration arrangements. All position classifications should be considered, including equipment operators, clerks, administrators, and professional personnel in order to properly plan for short

and long-term needs. Manpower planning will also help point routes of promotion and provide continuity of the system. Relevant and strong training program needs will also be indicated by this planning. Physical resources should not be ignored. Equipment and facilities needs, purchases, operating and capital costs, maintenance and salvage procedures must be planned and developed within the system.

Development of public acceptance for the needs and services of the system is critical to its success. An active public relations program should be a continuing part of the system's activities. In addition, important support and direction can be gained for the system through use of an advisory committee.

Operating and capital budgets must be prepared to plan and guide expenditures for the system for current and future periods. Sources of revenue to support expenditures must be identified. Regardless of the method or combination of methods used, efforts should be made to relate the actual cost of the integrated management system to adequate charges for the service provided. Finally, a means of controlling the system must be developed and maintained. Good accounting procedures with adequate records should be installed to measure not only financial aspects, but also services performed, safety performance, employee performance, employee development and retention, and public attitudes toward the service. If

private contractors are franchised or licensed to provide the services for the operating jurisdiction, many of the foregoing considerations will be his management responsibility. Nevertheless, the responsible public agency must insure that its contractors perform their management responsibilities efficiently and effectively in order to provide a high level of uninterrupted service at a reasonable cost.

All of these important planning and operating considerations are examined and discussed in the following sections.

Organization

The day-to-day implementation of technology and public service objectives requires an efficient and effective basic organization. Therefore, six points crucial to the development of an organization for solid waste management should be pointed out: (1) it should be designed to achieve planned objectives; (2) it should have authority and responsibility appropriate to the task at hand; (3) it should fit both legally and logically into the overall jurisdiction of which it is a part; (4) it must have adequate numbers of qualified personnel; (5) it must have adequate capital and operating finances; (6) it should be an integrated system that concerns itself with storage, collection, transportation, disposal, and possibly resource recovery and reuse of solid waste materials.

Appraisal. Existing organizational forms should be examined to determine their adequacy for solid waste management. Other organization possibilities should also be considered as to their application to solid waste management. Advantages and disadvantages, financing, establishment requirements, possible service effects and other aspects should be listed and considered. Objectives desired for the solid waste management system should be compared to this appraisal. The result of this comparison will yield design requirements for the system's organization.

Background information needed for this appraisal should be developed in the base studies as described in this document in Part Two, Governmental Structure.

Design Considerations. Areawide or regional approaches will be an important consideration as organizational possibilities for the overall jurisdiction. Operating forms, such as utilities, authorities, joint agreements, contractual arrangements, and agreements should be considered within the regional context. The concept of maximum operational authority should be observed. In essence, this approach states that, wherever possible, a solid waste management system should be installed throughout an entire region and operated universally on an integrated management basis. Everyone would receive solid waste service. In a rural region of three counties, for example, maximum operational

authority would mean that no person, business, city, or any entity would lack an approved standard of collection and disposal service. Charges for the service would apply universally and reflect accurately the total cost of the service, but allowing for varying charges for different levels of service. In an urban region, the maximum operational authority would encompass the entire metropolitan area.

Intergovernmental Mechanisms. In order for solid waste problems to be solved by planning and implementing solid waste management systems within regional configurations, appropriate legal organizational mechanisms must be established. They must be oriented toward intergovernmental cooperation and serve to unify the numerous and often conflicting individual jurisdictions characteristic of regional areas. In addition, the regional configuration selected should be conducive to the establishment of a solid waste management system on an integrated management basis having maximum operational authority. The operating region should be delineated in a way that maximizes the population that is served. Incompatibility will often require establishing a separate, but adjoining operating region. Delineation of a county or group of counties will often provide a convenient organizational framework for a solid waste management system.

Policymakers and planners of intergovernmental organizations for solid waste management must be concerned about the joint approach mechanisms available, including administrative arrangements, financing, management reporting, and areas of mutual responsibility. The following sections will examine these considerations in their relation to solid waste management.

Three main intergovernmental mechanisms are available: (1) the joint operation by two or more units of a service facility; (2) provision of a service on a contractual basis by one governmental unit to at least one other; (3) an overall operating district, authority, or utility supervised by a board of commissioners or directors with day-to-day operation delegated to a manager and staff. All three can be modified depending upon circumstances. Under each, the agency or operating authority responsible for facilities or services may use its own staff and facilities, those of the units receiving the service, or those of private suppliers or contractors.

Joint Operations. In all States, local units of government may agree under certain circumstances to jointly perform various public services. Generally, agreements can be used to undertake together any functions and responsibilities that each unit could undertake singly. Typical services might include police and fire protection, sanitation,

public health, joint operation and occupancy of public buildings, mass transportation, and water supply. The joint efforts can involve an exercise of powers or an agreement or contract for services. In the application to solid waste management, interest centers on the contract or agreement among units of government for the joint provision of a service.

The financing techniques used by a local government acting alone can usually be used in joint operations. User charges might be levied for direct operations and to retire revenue bonds. In other situations, funds might be provided from general revenues derived from tax levies imposed by each participating governmental unit or from special taxing powers of the solid waste management jurisdiction. Exact methods would depend upon State statutes or the preferences of the participants to the joint agreement.

Contractual Services. Municipal-type services provided under contract include those supplied by one governmental unit to other units, by private operators, or by some combination thereof. Many States have enacted legislation that enables its local units of government to enter into such agreements. Among their many advantages are the elimination of duplicate services, staffs, and expenditures among several neighboring units of government. Operations and budgets are also more easily planned. If private

contractors for services are utilized, the governmental unit does not have to hire and maintain its own employees. Furthermore, a contract with a private operator will fix costs for a definite period and thus provide a more positive planning base. Care should be used in drafting the contract, however, in order to insure high-level uninterrupted service by the contractor. In addition, the contract should be awarded for longer terms than has usually been the practice. In order to allow for capital commitment for trucks, sites, and other acquisitions as well as providing a stable work-force, a contract should be written for no less than five years.

Overall Operational Organizations. In approaching solid waste management on a regional basis, intergovern-mental agreements might be further formalized by establishing organizational entities that permit operations, possible taxing or user fee assessment powers, and the incurring of debt through various bond mechanisms. The operational organizations relevant to intergovernmental management of solid waste are authorities, special districts, and utilities. They are usually established according to specifications contained in each State's statutes. Intergovernmental agreements or organizations at the local level that cross State boundaries must be authorized by statute in each State affected--sometimes by a constitutional provision.

Congressional consent is usually not required for a local interstate organization, even though a type of interstate compact is involved.

Although there are advantages in having recourse to a specific organization with special powers, such as special districts and authorities, this approach should be taken with caution. It should be undertaken only after alternatives, such as an intergovernmental or contractual agreement, have been rejected. It has been far too easy to add layers of local jurisdiction each time a new problem arises. A satisfactory alternative, which combines certain advantages of several approaches, would be to organize, through an intergovernmental agreement, a regionwide authority that operates as a utility having maximum operational authority for an integrated solid waste management system. The authority-utility would have the power to license and regulate private contractors, regulate local government operations, or to undertake its own collection, transportation, disposal, reduction, and resource recovery operations and to establish and enforce all standards for a specific region. Financing its own facilities or leasing them to private contractors could be equitably done with funds derived from user charges and revenue bonds. Day-to-day management would be the responsibility of a manager answering to a board of directors. Another example involves a division

of authority and responsibility along functional lines for different governmental levels. For instance, operating under broad State regulation a regional agency would provide the capital investment and operation of transfer stations, sanitary landfills, incinerators, resource recovery stations, and other large facilities. Local jurisdictions would conduct collection services and other strictly local functions. Such activities would also require intergovernmental agreements governing operations, financial arrangements, and designation of responsibilities.

Financial Planning

Financial planning is an essential aspect of developing plans for solid waste management to provide means of financing the plans which are developed. Financing identifies and describes methods for providing funds for acquisition of facilities and equipment and their operation. Usually funds are derived from a mixture of several sources including long and short term debt, revenues generated from operations, tax levies, and sale of surplus assets. These sources and mixtures must be identified during planning. Questions to ask in developing plans are: can capital funds be obtained through general obligation or revenue bonds; what are our debt capacities; will general tax levies be applied over the service area, or can revenue be generated by direct service

charges; perhaps pay-as-you-go might be possible? Answers to these questions will help provide the basis for budgeting.

The budget is a plan showing how resources will be acquired and used over a specified time interval. Budgeting is a fundamental planning activity and the budget is one of the most effective techniques used in government and business to accomplish the objectives of management. Therefore, a solid waste management plan should include a capital budget describing investments in capital equipment and facilities, estimates of cost, and time of acquisition over the life span of the plan. An operating budget should also be included showing estimated operating costs for the first one or two years of the plan life.

Manpower Planning

A manager of a solid waste management system, as with any operation requiring large numbers of personnel, will find manpower needs and management of personnel one of his largest concerns. In order to reduce uncertainties about manpower needs for the future and to provide continuity in the solid waste management system, a manpower plan should be prepared and become part of the local or regional solid waste management plan. A plan for manpower should be a well-considered listing of all position classifications in the system, existing personnel in each classification, an

estimate of personnel required for these positions during a future period five or ten years hence, and estimated personnel costs for these periods. Retirements and other attrition should be anticipated by determining ages of employees and application of normal turnover rates. Reasonable estimates of "in" and "out" transfers should be included in these computations. Planning will permit provision of adequate numbers and kinds of personnel as well as chart paths of promotion of personnel to insure continuity of the organization. Planning for manpower should also include training needs and programs to prepare employees initially and to maintain their knowledge and skills during employment. Changing requirements for certain skills should be anticipated in the plan and become part of the retraining program. For example, inspectors might need training in the distribution and economics of secondary materials as emphasis shifts from disposal to recycling. The following workforms (Figures 6 & 7) will aid in organizing information and in computation.

WORKFORM

Solid Waste Management Organization

Classification	Age Groups									
	18-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total all ages
Management										
Administrative										
Engineers										
Sanitarians										
Other Professionals										
Technicians										
Enforcement Officials										
Licensing Officials										
Heavy Equipment Operators										
Sanitary Landfill Operators										
Incinerator Operators										
Transfer Station Operators										
Reclamation Station Operators										
Packer Truck Operators										
Other Collection Personnel										
Street Cleaning Personnel										
Totals Present										
5 Years										
10 Years										

Figure 6

WORKFORM

Solid Waste Management Organization

Manpower Losses*

5 and 10-year estimates

Classifications	Total all ages (Present)	Retirements	Transfers (Net)	Other Losses**	Total Losses	Estimated Available Manpower (5 years)	Estimated Available Manpower (10 years)	Needed Manpower (5 years)	Needed Manpower (10 years)
Management									
Administrative									
Engineers									
Sanitarians									
Other Professionals									
Technicians									
Enforcement Officials									
Licensing Officials									
Heavy Equipment Operators									
Sanitary Landfill Operators									
Incinerator Operators									
Transfer Station Operators									
Reclamation Station Operators									
Packer Truck Operators									
Other Collection Personnel									
Street Cleaning Personnel									

Estimated Total Personnel Costs 5 Years $_____
10 Years $_____

*From current manpower

**Includes voluntary and forced terminations, disabilities, deaths, and early retirements

Figure 7

Industrial Relations

As immediate challenge in many systems for solid waste management will be the insistence of employees to assert employee rights by means of work stoppages. Therefore, mechanisms should be adopted to help minimize stoppages and to permit continued service to the public.

Methods have been available and successful for many years in the private sector. These are: (1) acceptance and legal designation of a bargaining agent and unit; (2) negotiation of a collective agreement or contract; (3) grievance and arbitration procedures. Grievance procedures should be designed to resolve issues early in order to avoid entering into arbitration. Indeed, it is a public responsibility to assure a fair hearing of all grievances and demands in exchange for the public employee's agreement not to strike.

Nevertheless, strikes are always a possibility even if grievances are fairly heard by the public employer. Arbitration, therefore, should be used in public labor relations whenever possible in order to avoid work stoppages. Voluntary arbitration is preferable. However, if this procedure cannot be established then compulsory arbitration should be used particularly in emergency situations where work stoppages threaten to impair public health or welfare. Sometimes strikes happen although illegal in most public employment

places. This has been occurring with increasing frequency in recent years. For this reason a strike plan should be prepared in order to carry on essential services if negotiations break down. Legal steps must be considered as well as maintenance of security to public property. Information dissemination techniques should be ready for implementation in order to properly communicate with the public as well as the strikers themselves. In addition, procedures should be outlined for initial steps to take once the strike is over.

In contract negotiation the public employees will usually be represented by experienced union negotiators having full power to make contract commitments. Often this power to commit the public to contractual decisions hampers the public's bargainers. Therefore, procedures should be provided in the solid waste management plan of vesting authority for contract commitments in a responsible group composed of both public legislators and executives. For example, the public jurisdiction's collective bargaining team should include representatives from the jurisdiction's legislative body, such as the city council, or county commissioners, in addition to the chief executive's office, (but not the chief executive himself) personnel department, legal department, and a representative from the department in which the bargaining unit is employed. The public's collective bargaining team should be aware of and give special attention

to presenting the jurisdiction's objectives in the contract, determining key policies on management rights (public interest), work rules, job security, and relationships to civil service or merit system provisions.

Public Relations

During both planning and carrying out the plan an active promotional campaign should be conducted to improve the image of solid waste management. It should be demonstrated to the public what is considered the highest quality of solid waste management and what the public can do in achieving this quality. Several techniques and methods are available and include: (1) schedule talks and lectures to service clubs, schools, League of Women Voters, community action groups, government officials and others; (2) provide for information dissemination by newspapers, radio, and TV; (3) assemble and disseminate information on solid waste practices and environmental conditions; (4) obtain and develop information materials including pamphlets, books, films, and monographs.

Advisory Committees

Advisory committees have good potential for guiding and supporting a solid waste management planning and implementation program at the State, local, or regional levels. The specific purposes of the advisory committee should be

determined and criteria then established for selecting members. An advisory committee might be formed to provide, for example, only technical advice to the solid waste management planning agency. If this is the purpose, then it is important that advisory committee members be capable of providing technical expertise in various aspects of solid waste management. However, an advisory committee with broader responsibilities might serve the following functions: (1) to provide technical insight; (2) to assure adequate coordination with other public agencies, such as those concerned with air, water, local government, and State and regional planning; (3) to provide an interface between solid waste planning and operations if these activities are part of different agencies; (4) to offer policy direction.

If possible, advisory committees should be limited to presentation of recommendations and resolutions of approval. Disagreements should be resolved or modified during sessions of the committee. Final decisions ideally should reside with the responsible solid waste management agency.

Property and Equipment Management

The plan should incorporate specific provisions for acquisition of equipment and other capital property on a scheduled basis with full consideration of capital and operating cost and source of revenues. In addition, provision

should be included for maintenance, retirement, and final disposition of all property. The workform shown on Figure 8 suggests an example of a capital property acquisition schedule.

In addition, the plan should provide for physical protection of these properties against carelessness and theft. Inventories of spare parts and salable reclaimed materials should be well-controlled through adequate record-keeping of incoming and outgoing items. Properties should be covered adequately by insurance while employees directly handling these properties should be bonded. This form of protection provides for recovery after a loss has been incurred but in itself does not prevent loss. A not so obvious loss to property is that resulting from little or no maintenance. Poor maintenance can result in higher than planned operating costs, interrupted solid waste services, and earlier than planned replacement. Therefore, the plan should also include provisions for a preventative maintenance program to insure that all property will remain serviceable during its planned life.

WORKFORM

CAPITAL ACQUISITIONS SCHEDULE

Capital Item	Estimated Total Cost	Budget 1970	1971	1972	1973	1974	1975	Total Six-Year Program	Long-Range Proposals to 1980
SLF Site #1	$ 50,000	$ 50,000						$ 50,000	
SLF Site #2	100,000					100,000		100,000	
Incinerator (HT)	5,000,000								5,000,000
Transfer Station	500,000				500,000			500,000	
Reclamation Yard	75,000			75,000				75,000	
Grinder Station	250,000			250,000				250,000	
Scales (3)	54,000	18,000				18,000		36,000	18,000
Scale Equipment	30,000	10,000				10,000		20,000	10,000
Dozers (3)	150,000		50,000	50,000			50,000	150,000	
Lo-boy Trailer (1)	7,200			7,200				7,200	
Compactors (2)	12,000	6,000				6,000		12,000	
Track Loaders (3)	180,000		120,000					120,000	60,000
Water Trucks (2)	33,000		16,500			16,500		33,000	
Packer Units (10)	120,000	24,000		36,000		36,000		96,000	24,000
Truck Units (20)	160,000	40,000		56,000			24,000	120,000	40,000
Totals	$6,721,200	$148,000	$186,500	$474,200	$500,000	$186,500	$74,000	$1,569,200	$5,152,000

TOTAL 1970-1975 Short-range and Long-range Proposals 1976-1980 $6,721,200

Figure 8

Control and Evaluation

An important function of management is the evaluating of results achieved by utilizing resources. Although evaluation procedures are not common in solid waste management, they should be. Too frequently, solid waste management performance is not critically evaluated. Consequently, service often deteriorates, inefficiency abounds, and costs increase faster than necessary. But what parts of solid waste management need evaluation to possibly improve performance?

While one solid waste management system will differ from another there are some common factors which should be evaluated. For example, costs of manpower, equipment, supplies, and facilities are critical to the effective and efficient operation of a solid waste management system. These and other critical cost factors must be identified so the manager can evaluate and control them. Furthermore, critical costs should be broken out into manageable units, because when costs are aggregated it is difficult to pinpoint problem areas. A useful tool for evaluation of solid waste management performance is the operating ratio. Ratios are expressed as mathematical proportions between major cost or resource expenditures and performance elements in the management system. For example, in considering the entire collection workforce an important relationship for

controlling manpower costs and scheduling route time might be the ratio of one collector manday to tons of solid waste collected. Suppose, for example, one collector is normally able to collect four tons of solid waste in a task day as based on an overall workforce mean average. The ratio value would be 0.25 as shown in the equation:

$$\frac{1 \text{ Collector Manday}}{4 \text{ Tons Solid Waste}} = 0.25$$

A norm might be established at the 0.25 figure for the entire collection workforce and related to the total tonnage collected. A variance from this norm would indicate to the manager that a change in operation had occurred. An unfavorable change in operation, for example, could result in higher costs per ton collected. If this variance persists therefore, the manager should determine the exact cause and take corrective action if needed. However, in using ratios, system norms must be established based upon method of operation and levels of service. In all cases accurate measurements must be made and records kept in order to make reliable and valid evaluations.

Other ratios could be developed which would help evaluate frequency of accidents or performance of equipment during a working period. Business ratios are useful in solid waste management too. An example is the "current ratio" which is a relationship of current assets-to-current

liabilities. This ratio is common in private business and is useful in giving a general picture of the adequacy of the working capital of a company and the company's ability to meet its day-to-day payment obligations.

The use of operating ratios in solid waste management, if carefully selected and applied, can provide measurements which could make better management easier. A higher level of service, at a more equitable cost for the consumer could well result.

PART THREE: REFERENCES

Clark, R.M., and R.O. Toftner. Financing municipal solid waste management systems. Journal of the Sanitary Engineering Division, Proc. ASCE, 96(SA4):885-892, Aug. 1970.

Clark, R.M., R.O. Toftner, and T.W. Bendixen. Managing solid wastes as a utility. The American City, 86(2)45-47, Feb. 1971.

Clark, R.M., R.O. Toftner, and T.W. Bendixen. Solid waste management; utility concept. Journal of the Sanitary Engineering Division, Proc. ASCE, 97(SA1):33-40, Feb. 1971.

The International City Managers' Association. Municipal public works administration. Chicago, 1957. 449 p.

Kennedy, H.W. A new role for the urban county? - the Lakewood plan. In Capitol, courthouse, and city hall. Morlan, R.L., ed. Boston, Houghton Mifflin Company, 1950. p. 224-227.

Miller, D.E. The meaningful interpretation of financial statements. New York, American Management Association, 1966. 238 p.

Minnesota. Sessions laws. An act creating a metropolitan council for the counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington; providing for the operation thereof. chap. 896, H. F. No. 1508, 1967. (Codified in Minnesota stat. annotated. chap. 473B. Metropolitan Council {new}.)

Minnesota. Sessions laws. An act relating to the Metropolitan Council; providing for the creation of a sewer service board and prescribing its duties and powers; providing for the collection, treatment and disposal of sewage in the metropolitan area. chap. 449, S. F. No. 237, 1969. (Codified in Minnesota Stat. annotated. chap. 473C. Metropolitan Sewer Service {new}.)

Minnesota. Sessions laws. An act relating to the Metropolitan Council; providing for county solid waste plans to conform to the Metropolitan Council plan. chap. 847. (Codified in Minnesota stat. annotated. chap. 473D)

Moore, C.L., and R.K. Jaedicke. Managerial accounting. 2d ed. Cincinnati, South-Western Publishing Company, 1967. 722 p.

Toftner, R.O., and R.M. Clark. Intergovernmental approaches to solid waste management. U.S. Environmental Protection Agency. Washington, U.S. Government Printing Office, 1970. 18 p.

Yoder, D. Personnel management and industrial relations. 6th ed. Englewood Cliffs, N.J., Prentice-Hall, Inc. 1970. 784 p.

Zausner, E.R. An accounting system for incinerator operations. Public Health Service Publication No. 2032. Washington, U.S. Government Printing Office, 1970. 17 p.

Zausner, E.R. An accounting system for sanitary landfill operations. Public Health Service Publication No. 2007. Washington, U.S. Government Printing Office, 1969. 18 p.

Zausner, E.R. An accounting system for solid waste collection. Bureau of Solid Waste Management Prepublication (SW-27ts), 1970.

PART FOUR: MANAGEMENT TECHNIQUES

A number of quantitative management techniques are applicable to the field of solid waste planning and management. These include statistical methodologies which are appropriate for analysis and forecasting of solid waste generation rates, population, economic conditions, and future land uses. Other techniques aid in scheduling, budgeting, and evaluation. For example, the techniques of PERT/CPM and the methodologies of PPBS and operations research are receiving increasing use among planners and managers in government and private industry. Further, the continuing need for information to support planning process systems has resulted in greater attention to design and development of management information systems (MIS).

The diversity of skills and knowledge required for application of specialized management techniques, and indeed planning itself, demands a project team approach. Use of project teams with interdisciplinary representation is a requisite in operations research and desirable in solid waste management planning. An interdisciplinary solid waste planning team might typically include: an urban or regional planner, management specialist, engineer, economist, operations research specialist, lawyer, and ecologist. The project manager might come from these or other disciplines although he should be capable of leading the team to results through creative synthesis of the team's special skills and knowledge.

Program Evaluation and Review Technique and Critical Path Method (PERT/CPM)

These planning and control techniques lend themselves best to project planning and are accomplished through time-event network analysis. The initial development of a plan for solid waste management could be scheduled by PERT/CPM. In order to apply PERT/CPM, three basic questions about the project should be asked: (1) What tasks must be finished before this task can begin; (2) What tasks can be accomplished concurrently; (3) What tasks can begin after another task is partially complete?

Scheduling is flexible with PERT/CPM to the extent that project activities may be scheduled according to their normal times of completion or speeded along a crash or modified crash plan. Crashing will result in higher cost for the project, but the lowest increase in cost is selected so that a reasonable trade-off between increased cost and project length results.

Planning-Programming-Budgeting System (PPBS)

This is a management tool that provides for a method of rational decision-making in government. A characteristic of PPBS is that output measurement of a given unit of effort is required (e.g., crimes prevented because of added policemen, incidence of disease reduced because of immunization programs,

or reduction of open dumps because of added manpower units for inspection and enforcement, etc.) rather than just input (i.e., money, manpower, and time). The basic elements of PPBS include: (1) consideration of future implications of any programmed effort; (2) identification of a governmental unit's objectives and relating all activities, regardless of organizational responsibility to these objectives; (3) consideration of all pertinent costs (operating and capital); (4) systematic analysis of alternatives for reaching objectives. This would include estimation of total cost of each alternative as well as resulting major cost and benefit tradeoffs involved with the alternatives.

In jurisdictions installing PPBS, the planning and implementation activities of the solid waste management agency should be designed to relate to this system. Use of the planning procedures presented in these guidelines, especially those aspects concerned with setting objectives, and measuring results in problems solved, will permit the plan to be readily adapted in PPBS.

Linear Programming

This mathematical technique is useful for finding the best or optimum uses of limited resources. It is based upon the linear or proportional relationship among two or more variables. Linear programming (L.P.) has several valuable

applications in improved solid waste management. For example, L.P. can make possible the design of an optimal collection network, or determine which combination of several alternative locations for proposed transfer stations would be best. The best disposal, reduction, or reclamation sites could also be located with L.P. Use of the L.P. technique could result in a maximum of solid waste service to the community with a minimum of cost. Furthermore, several alternatives, or courses of action not apparent otherwise, might be revealed by L.P.

Use of L.P. requires adequate data yielded best by good accounting of costs and performance. Adequate data is needed for the variables used in L.P. equations to express the L.P. objectives of maximized system performance with minimized cost.

Queuing Theory

This is a method for dealing with waiting lines in a way that results in an optimum lowest cost for both the waiting line and the service facility. For example, if it could be shown that packer trucks unloading and waiting to unload at a transfer station was more expensive than providing an additional unloading bay, the cost of building the additional bay would be justified. Construction of the bay would result in lowered operating cost plus faster collection

service because the packer truck could return to its route more quickly. This is the essence of queuing theory applied to solid waste management. Planning the solid waste management system will afford several similar opportunities to apply queuing theory.

Management Information Systems (MIS)

Adequate, accurate, and current information is necessary to support a solid waste planning and management system. Minimum informational needs are dependent upon the detail of planning and level of management. There must be enough information, however, to develop a definitive plan as well as direct and evaluate a management effort. Establishing a management information system can be divided into three main activities. These activities are system analysis, system design, and system development.

System Analysis - This entails examination of the system to determine how it works. What is the present informational flow? How can this information flow be harnessed to provide continuing management data? Obviously, a detailed knowledge of the organization is required to conduct the system analysis. Therefore, care should be taken to include participation of department heads and operating personnel at the project's beginning. These people contribute to the informational flow of the present system and will ultimately be served by the new MIS.

System Design - In designing the system its purpose must be defined. How do we want the system to work? Who will use the system? Why is the system necessary? Objectives of the system must be determined and stated with design appropriate to achieve these objectives. Advantage should be taken of the information generated by the system. For example, information flow should be organized and gathered in a systematic way from daily operations of managers and supervisors, from the accounting procedures, from the licensing activity, and from the inspection and enforcement program. Other useful sources of information may be appropriate too, and these sources will be revealed during the system analysis.

Typical information needs might include locations and conditions of disposal, reduction, and reclamation facilities, routing schedules, accident types and frequencies, equipment types and conditions, maintenance schedules, costs of collection and processing, inventories of reclaimed materials, and personnel activities. Basically, information needs will resemble the listing in the Plan Report Outline contained in Part Six of this document. In addition, models, linear programs, regression analysis techniques, decision tree networks, decision grids, and other management tools could be designed into the system to provide it with a more ready-to-serve capacity in everyday operations.

Because of the amounts and complexity of much of the data, computer-based systems should be considered. Use of

the computer will facilitate storage, retrieval, and general data handling. Often the planning or operating jurisdiction will have unused time on its existing computer equipment which can be applied to the solid waste management system. If computers are not immediately available computer time can be purchased on a time-sharing basis from other governmental agencies or from companies providing this service.

System Development - Implementing the system which has been designed involves establishment of procedures for data collection and handling, machine or computer time purchases, file organization, training of operators, and the other action steps required to carry out the system design. System development can present a complex scheduling and management problem which could be simplified through the use of PERT.

Periodically, the management information system should be evaluated in terms of its contribution to the planning process and management activity. Determination should be made of the adequacy of existing information, needs for further information, and the possible deletion of extraneous information. Although evaluations will occur concurrently with the system's use, a general evaluation and inventory should be conducted annually.

PART FOUR: REFERENCES

Cannella, A.A. Queuing analysis applied to a municipal service. Paper, Tennessee Technological University, Aug. 20, 1967. 17 p.

Clark, R.M. Economics of solid waste investment decisions. Journal of the Urban Planning and Development Division, Proc. ASCE, 96(UP1):65-79, Mar. 1970.

Clark, R.M., and B.P. Helms. Decentralized solid waste collection facilities. Journal of the Sanitary Engineering Division, Proc. ASCE, 96(SA5):1035-1043, Oct. 1970.

Hartman, W., H. Matthes, and A. Proeme. Management information systems handbook. New York, McGraw-Hill Book Company, 1968.

Hatry, H.P., and J.F. Cotton. Program planning for state, county, city. State-Local Finances Project. Washington, George Washington University, Jan. 1967. 72 p.

Helms, B.P., and R.M. Clark. Locational models for solid waste management. Journal of the Urban Planning and Development Division, Proc. ASCE, 97(UP1):1-13, Apr. 1971.

Klee, A.J., and G.A. Garland. Decision trees in solid wastes planning. Public Works, 99(7):74-77, July 1968.

Meresman, S.J. P.E.R.T. - program evaluation and review technique. {Cincinnati}, U.S. Department of Health, Education, and Welfare, 1970. 35 p.

Thierauf, R. Decision making through operations research. Ed. by R.A. Grosse. New York, John Wiley and Sons, Inc., 1970. 570 p.

Truitt, M.M., J.C. Liebman, and C.W. Kruse. Mathematical modeling of solid waste collection policies. 2 v. {Washington}, U.S. Department of Health, Education, and Welfare, 1970. 289 p.

PART FIVE: IMPLEMENTATION

Although closely related to planning, implementation is a distinct step marking the apparent end of planning and the beginning of action. In actual practice, planning never ends, while implementation frequently becomes necessary before the plan is first completed. Therefore, as soon as officials have been prepared to make implementing decisions, they should be encouraged to do so. Making decisions during the planning increases interest and results are quickly obtained. In this document, the concept of implementation will consist of program and operating activities in contrast to the steps and procedures already characterized as part of the planning process and described in the Basic Planning Model. Activities considered critical to the implementation of a local or regional solid waste management plan would include organization, staffing, financing, acquisition, construction, and management of facilities, acquisition and management of equipment, providing of service, public relations, training, continuing planning, and general management and control. Implementation should be carried out according to a schedule and order of priority. Responsibility of action, estimated costs, and objectives of the implementation should be specified.

Organization. Requisite for implementation of a solid waste plan is an organization. An overall jurisdiction with operating divisions and sections must be formed. This organization can take many shapes, but an area-wide agency having

maximum operating authority would be frequently advantageous. Various organizational mechanisms having the best operating characteristics should be considered. Utility or authority forms offer ready adaptability to solid waste management operations having maximum operating authority characteristics. The divisions and sections of the organization should be designed to provide necessary organizational support functions and to carry on an integrated approach to management of storage, collection, transportation, reduction and disposal, and reclamation. Implementing the organization should also include policy and procedures development and execution, contract management and legal affairs activities, forms, records, and reporting system installation, and establishment of a board of directors and a possible advisory committee. Operating management should be appointed, consisting of a chief executive or administrator followed by division and section managers. Overall organizational staffing should proceed as the next logical step.

Staffing. Personnel recruitment and selection is part of implementing solid waste management plans. The provision of personnel can be guided by present needs and those needs forecast in the manpower planning section of the plan. Adequate methods of selection to assure qualified personnel should be used. After hiring, modern methods of personnel management and industrial relations should be applied.

Finance. Methods of capital and operating financing must be established. Funds may be derived from debt instruments, tax levy, or from revenue produced by operations. A combination of these funding methods might be used. Proposals for methods of obtaining financial assistance from other agencies should be included. Budgeting procedures for both capital and operating needs must be installed in the system to provide a long and short-term financial planning and management tool. Finally, adequate records concerning financing and budgeting must be installed and maintained. These records should be subsidiaries of the overall accounting system of the operating organization.

Acquisition of Facilities. Implementing a solid waste plan will require acquisition and development of facilities, which might include land, buildings, trucks, earthmoving and other equipment. Site location, architectural and engineering design, and construction will be required. Performance desired of equipment must be determined and specified prior to acquisition. Management of all facilities and equipment must be provided.

Providing Service. The primary function of the solid waste organization is to provide the solid waste services of collection and disposal. In addition, services extend to specification of storage standards and transportation of solid waste. Objectives and responsibilities of each operational agency will vary, but additional services might include many of the following:

Non-residential waste problems might be studied in order to provide expanded service by collecting and disposing of them. These wastes might include those generated by hospitals,

schools, correctional institutions, and industrial or commercial concerns. In area-wide solid waste management organizations technical assistance in solid waste management might be provided participant local government, industry, or commercial establishments. Further services might include inspection of equipment, facilities, and storage practices under the auspices of State regulation or as part of the local regulatory responsibility. Reclamation of materials for recycling is a service which might be conducted or sponsored by the solid waste management organization. Sale of reclaimed materials could help offset operating costs or retire debt. In either case the consumer of solid waste services would benefit through lower cost of the service.

Public Relations. An active and imaginative public relations program should be established and conducted. This will help build the image of solid waste management, demonstrate standards of high performance of solid waste management so that the public becomes accustomed to high performance and continues to demand it, and generally informing the public about how solid waste management relates to other aspects of their daily lives.

Training. The solid waste operating agency may wish to determine the status of technical skills currently available in the conduct of solid waste management and to assess the need for increased technical competencies to fulfill future needs. Pre-service and in-service training in solid

waste management might offer an approach for developing needed knowledge and skills. A training program might include the following activities: (1) encouraging management and technical training in colleges and universities (solid waste courses could be included in undergraduate, graduate, and extension curricula); (2) arranging for field courses and demonstrations (such as visiting a sanitary landfill in operation) for public officials, operating personnel, and other interested parties; (3) special training for operating personnel to prepare them for certification examinations.

Continued Planning. A significant part of the local or regional solid waste management plan should be aimed toward the development of a continuing planning program for furthering effective solid waste management. Under this program there might be the following activities: (1) periodic review and updating of the local and regional plan. This review might require the development of an inventory system to regularly update the data and evaluate the status of current solid waste management practices. A management information system (MIS) is extremely useful for this purpose. (2) Periodic assessment of the implementation progress of local or regional operations. (3) Continuing technical, financial, and legal consultation, guidance, and assistance to participant solid waste management units in the region. This service could also extend to industry, agriculture, and commerce.

(5) Periodic evaluation of the solid waste plan in reference to the overall comprehensive plan of the jurisdiction.

General Management and Control. The solid waste management organization will be required to conduct various administrative functions. These functions will typically include accounting services and billing, fiscal controls, performance evaluations, certification of operators, licensing and franchising, contract management, insurance administration, payroll administration, personnel management, industrial relations, and record-keeping. Procedures for these administrative functions should be established.

In addition, general management activities should include the drafting, consideration, and sponsoring of new legislation or ordinances dealing with solid waste management. The administration of the planning process support system, such as a management information system, should be part of general management.

Important among general management activities is that of coordination. Solid waste planning should be coordinated with activities of other related agencies. In most jurisdictions other operating or planning agencies may have interests that would overlap with those related to the development of implementation of a planning program for solid waste disposal. These might include official agencies such as the State or regional planning agencies, streets or highway departments, industrial commission, air and water

pollution control agencies, as well as a variety of local or unofficial agencies or groups. A major objective of the grant support authorized by the 1965 Solid Waste Disposal Act and the 1970 amendment (Resource Recovery Act of 1970) is the coordination of solid waste planning with other planning. Thus, the solid waste agency should not only consider the agencies with which planning will be coordinated but also indicate the specific ways in which coordination will be assured. Coordination is specifically required with air and water pollution control and land use planning and with planning activities supported with funds provided by Section 701 of the Housing Act of 1954, as amended. Other coordination is required under Office of Management and Budget circular A-95. Comprehensive Health Planning (PL 89-749) offers another opportunity for coordinative effort for mutual solution to area-wide problems. Coordination of local or regional solid waste disposal planning should be developed with the activities of other agencies within the jurisdiction as well as with the State solid waste disposal planning agency. This coordination will aid in development of local or regional plans as well as provide mutual access to planning data and joint promotion of comprehensive plans.

Many State solid waste planning agencies have developed capabilities to provide technical assistance and plan review to local or regional solid waste agencies. Although emphasis

is needed on developing regional or areawide plans, local plans should not be neglected. Rather, they should be developed and coordinated for inclusion in the larger regional plan. Certain elements such as operating standards, legislation, and regulations should be uniform within region and State. In order to ensure the effective coordination of all planning efforts throughout a jurisdiction, the solid waste planning agency should develop and implement its plan with the full support, knowledge, and assistance of pertinent local, regional, and State jurisdictions. Indeed, many of the activities carried out by a solid waste planning agency will require the support and assistance of other local, regional, and State agencies. Examples of coordinated operational organizations were presented in Management Considerations, Part Three of this document.

PART FIVE: REFERENCES

Black, R.J. Safe and sanitary home refuse storage. Public Health Service Publication No. 183. Washington, U.S. Government Printing Office. Rev. 1962, 1968. 6 p.

Brunner, D.R., D.J. Keller, C.W. Reid, Jr., and J. Wheeler. Sanitary landfill guidelines--1970. Unpublished document.

DeMarco, J., D.J. Keller, J. Leckman, and J.L. Newton. Incinerator guidelines--1969. Public Health Service Publication No. 2012. Washington, U.S. Government Printing Office, 1969. 98 p.

Gilbertson, W.E., R.J. Black, L.E. Crane, and P.L. Davis. Solid waste handling in metropolitan areas. Public Health Service Publication No. 1554. Washington, U.S. Government Printing Office, 1966. 41 p.

Gunnerson, C.G. Marine disposal of solid wastes off the west coast. {Cincinnati}, U.S. Department of Health, Education, and Welfare, 1970. 32 p.

Sorg, T.J., and H.L. Hickman, Jr. Sanitary landfill facts. 2d ed. Public Health Service Publication No. 1792. Washington, U.S. Government Printing Office, 1968. 30 p.

Toftner, R.O., D.D. Swavely, W.T. Dehn, and B.L. Sweeney, comps. State solid waste planning grants, agencies, and progress, 1970. U.S. Environmental Protection Agency. Washington, U.S. Government Printing Office, 1971. 26 p.

Vaughan, R.D. Management of solid wastes from hospitals: problems and technology. In Use and disposal of single-use items in health care facilities; report of a national conference, Dec. 4-5, 1968. Monograph No. 6. Ann Arbor, Mich., National Sanitation Foundation, 1969. p. 41-46.

PART SIX: PLAN REPORT PREPARATION

Much of the material presented in the Plan Report Outline at the end of Part Six is self-explanatory. The content of the foreword or preface, table of contents, and the introduction will largely be suggested by the subject matter included in the plan text. Thus, these guidelines will not dwell on those aspects. Explanation will begin with Section II of the outline, the summary, and proceed through the appendices.

Summary (Section II)

By summarizing the findings and recommendations for quick reference, the plan report can be made more useful as a working document. This summary is usually placed at the beginning of the report and should note the pertinent page, paragraph, table, or appendix as the appropriate reference for any summarized information. Furthermore, a good summary section can be excerpted in its entirety from the plan report, separately reproduced, and used for public information purposes. A special condensation of the summary can be made into public relations materials to gain citizen support.

Background of the Planning Area and Existing Conditions (Sections III and IV) (Base Studies)

The third and fourth sections of the plan document provide the framework for planning and an appraisal of the existing situation. In the planning process this is characterized by collection of data, an essential part of the planning process (Figure 1, step 2). Without data it would be futile to attempt to forecast, determine needs, or set objectives. Data and information will be diverse, of varying quantity and quality, and only some will be useful for developing a plan for solid waste management. The Base Studies (Part Two) section of this document outlines in detail data generally needed in development of a local or regional solid waste plan. In developing its plan, each jurisdiction should be selective in its data. Data collected by the State for the National Survey of Community Solid Waste Practices will be one of the important sources of information. This source will provide much data about solid waste handling practices and facilities in communities throughout the State, including information on solid waste storage, collection, reduction, and disposal methods related to particular areas, types and locations of disposal and reduction facilities, budgets for solid waste management, population, zoning, and other community information. This information can be retrieved and analyzed for planning

on a local, regional, State or national basis. More detailed and precise data than that provided in the National Survey, however, is required to plan for action programs. It is essential that information about all solid waste sources and supporting management systems be gathered to build the needed data base. Additional data about community planning and development has become available in recent years. For more detailed solid waste management planning, these sources should be tapped for data on land use, economics, population, finance, transportation, housing, air and water quality, and the physiography of planning areas.

Future Conditions (Projections, Section V)

To determine where, to what extent, and at what level of persistence these conditions will prevail during the period of the plan, there must be analysis of existing conditions in a future context. This requires forecasting, the importance of which cannot be overemphasized. Correct forecasts identify problems before they occur, permitting predetermined solutions. This is one of the keys to successful planning. Lack of forecasts, or worse, wrong forecasts, allow problems to appear without warning, or solutions to be ready for the wrong problems. Statistically correct procedures are important in making forecasts.

Methodology should, however, be tempered with good judgment. A forecast might be statistically correct, but does it appear reasonable under the circumstances?

When making forecasts, as well as when presenting the forecast data, it is often helpful to use working forms or tables, thus presenting comparisons and trends and revealing similarities or differences (Figure 9). Such forms for forecasting may be used eventually as tables in a plan document. Similar methods should be used for other data forecast during the planning process. In addition, illustrations can be of considerable aid to data presentation. Relatively simple charts, graphs, and tables are suggested for this purpose. It makes little sense to complicate graphic presentations when their basic purpose is to clearly convey information.

Objectives (Section VI)

The overall mission of a solid waste management plan is to solve the various problems connected with solid waste in the jurisdiction. Each jurisdiction implicitly or explicitly adopted this mission before beginning any planning. Indeed, the main reason for developing a plan at all is the desire to achieve this basic mission.

Detailed objectives will emerge as a natural outgrowth of problem definition while data is collected and analyzed during the early stages of the planning process. Objectives

SAMPLE FORM TO FORECAST REQUIREMENTS FOR SANITARY LANDFILL ACREAGE

Solid Waste Management

County/Region	Current population (year)	Forecast population (year)	Current per capita generation (year)	Forecast per capita generation (year)	Tons generated Current/forecast	Estimated acre-ft fill space needed Current/forecast

Figure 9. This form can be helpful in organizing data and making calculations for local and regional planning where sanitary landfill capacities are important.

and solutions for solid waste problems are to be achieved through implementation of the plan. Objectives should be carefully selected and stated in measurable terms. As a formalized procedure, selection of objectives might proceed by examining each significant solid waste problem discovered in the analysis of existing data. The problem's relevance for the future should be given along with a definitive statement of the objective and proposed strategy in the form of a recommendation for solution. These solutions require implementation of a plan. The following examples illustrate the procedure.

(Example 1)

Problem Definition: That 60 percent of the Regional Solid Waste Utility's collection vehicle fleet will need replacement during the next two years. Furthermore, new vehicles in the fleet experience serious maintenance problems after only two years of operation.

Objective: To replace 60 percent of the present collection fleet on a scheduled basis during the next two years as well as extend the useful life of new vehicles beyond a two-year life.

Constraints:

(a) Equipment funds not budgeted.

(b) Lack of preventative maintenance program.

(c) Lack of equipment replacement plan.

Resources:

(a) 40 percent of fleet will remain operable during the next two years.

(b) a change from general obligation funding to adequate user charges will provide partial funds.

(c) existing packer truck drivers can perform daily maintenance.

Recommendation for action (Strategy): (a) budget (capital and operating) for acquisition and operations to include collection vehicle replacement; (b) develop a proposed user charge schedule; (c) develop a proposed preventative maintenance program; (d) develop proposed schedule for providing five-year life for vehicles; and (e) present budget proposals and strategy support documents to the Utility board of directors during the next budget hearings.

(Example 2)

Problem Definition: According to the solid waste survey conducted during this jurisdiction's planning program it was found that 85 percent of the jurisdiction's citizens are unaware of the need for solid waste disposal facilities.

Objective: To increase to 60 percent within one year the public informed about the solid waste disposal requirements and the current efforts to provide necessary facilities.

Constraints:

(a) Public information funds not budgeted.

(b) No capability for conducting a public information program.

(c) Lack of specific information to disseminate.

Resources:

(a) Information is being developed in volume as part of the planning program.

(b) Three television stations and five radio stations serve this area. Public service spots can probably be provided free-of-charge.

(c) Some of the agency's professional staff have journalistic ability by virtue of their report writing activities.

Recommendations for action (Strategy): (a) Budget funds to carry out a one-year public information program using staff, public service spots in communications media, and publication facilities of the agency. (b) The public information program will include news releases, newsletters, and a speaker's bureau to disseminate information about the problems of solid waste and the measures being taken to solve these problems.

Any objective developed should be directly related to a specific recommendation for intended action in the plan. Resources available for achieving objectives and constraints hampering achievement should be identified and assessed.

In developing objectives it might be useful to actually tabulate problems, suggested objectives, assessment of constraints and resources and possible planned action on a working form (Figure 10). The form takes the approach used in Examples 1 and 2 and provides space for inserting specific implementing actions designed to achieve objectives. The Recommendations section or Plan will contain the specific actions required to achieve objectives.

Recommendations for Action (Section VII)

This section of a plan report is essentially the plan strategy. A jurisdiction's intentions and basic methods for achieving objectives that will help solve its solid waste management problems should be specifically stated and elaborated here. As suggested, a working form can be used advantageously in developing this section of the planning report, since recommended planned solutions to solid waste management problems have already been related to objectives. In addition, however, the recommended solution should be considerably elaborated with a view to designating major actions required, responsibilities, priorities, timing, locations, estimated costs, and the problems that will be solved.

Planned action could be organized on a working form (Figure 11). Such a form would simply structure and elaborate

SAMPLE WORKING FORM TO DEVELOP OBJECTIVES

Planning Work Form

(1) Problem Definition:

(2) Objective:

(3) Constraints:

(a)

(b)

(c)

Resources:

(a)

(b)

(c)

(4) Recommended Planned Action (Strategy):

Figure 10. It is helpful to systematically relate problems to objectives and actions if tabulated on a form like this.

SAMPLE PLANNING WORKFORM FOR PLAN DEVELOPMENT

Statement of Problem:

Recommended Planned Action (Strategy):

Summary of Planned Action

Timing (year)	Priority	Jurisdictional responsibility	Location	Estimated costs	Related problems solved

Figure 11. This form permits organization of planning proposals geared to specific problem solution within a context of time, responsibility, money, and evaluation.

the recommended planned actions stated in an objectives development planning workform (Figure 10).

Implementation (Section VIII)

Implementation of a plan is the process of activating the recommendations for action. Descriptions of possible implementing action are included in Part Five of this document.

Appendices (Last section of report)

Supporting data, references, tables, maps, and explanation of methodologies, should be placed in appropriate appendices in order to avoid a cluttered plan text. References to this material can be made in the text using notations or footnotes. This enhances readability of the text and avoids the possibility that important recommendations may be overlooked. In some jurisdictions, both the plan text and supporting data might be sufficiently voluminous to justify two separate report volumes. One would contain data while the other would serve as the plan text containing recommendations, priority listings, and schedules.

Plan Report Outline

The basic planning model (Figure 1) can be translated into an outline for the plan text. Such a format illustrates the logic inherent in the planning procedure. Planning initiative and innovation are desirable, however, and each jurisdiction is expected to formulate its own systematic outline and report, taking into account its particular needs. The text in Part Six explains in detail the elements that would be contained in a plan report conforming to this outline.

SAMPLE FORMAT FOR REPORTING THE PLAN

Brief Guide

Corresponding steps in the model	Elements of the Report
1	Foreword or Preface (or both)
	Table of Contents
	Section I Introduction Purposes of the plan.
	Section II Summary (Note: This section should be the last section prepared in the plan report and may come at the end of the report, if desired).

Corresponding steps in the model	Elements of the Report	
2	Section III	Background of the Planning Area (General) (Base Studies)

*1. Jurisdictions

*a. State
b. Regions
c. Planning areas
d. Metropolitan areas
e. Council of Governments (COG's) jurisdictions
f. Counties
g. Municipalities
h. Special districts
i. Other

2. Physical Conditions

a. Environmental conditions
b. Geology and soils
c. Climatology
d. Drainage basins
e. Other

2	Section IV	Existing Conditions (Specific) (Base Studies)

1. Arrange data according to specific needs of the planning agency. Data collected for the 1968 National Survey of Community Solid Waste Practices is the basic source for this plan section. But such data would have to be augmented by other types of information.

2. Describe and analyze all existing conditions affecting management of municipal, industrial, agricultural, and mineral wastes, etc.

*Arabic enumerated and alphabetized items illustrate sample subject matters.

Corresponding steps in the model		Elements of the Report
		a. Storage, collection, and transportation practices b. Disposal and reduction facilities c. Quantities of wastes collected, disposed of, and generated, with generation rates d. General management practices (e.g., utilization of manpower and equipment) e. Population (size and densities) f. Housing (types and locations) g. Land uses (residential, commercial, industrial, agricultural, extractive, recreational, and other relevant land uses) h. Transportation corridors i. Levels of acceptability, service costs, and other relevant State, regional, and community conditions. j. Public awareness and knowledge about solid waste problems and service requirements k. Expenditures for solid waste management l. Tax base (assessed valuations) m. Tax rates n. Public finance practices o. Status of legislation p. Economic base q. Other
3	Section V	Future Conditions and Problem Definition
		1. Relevancy for the future (from the analysis of the data of existing conditions accumulated in sections III and IV, determine which conditions will have a bearing on the future).

Corresponding steps in the model	Elements of the Report
	2. Future problems defined a. Types b. Locations c. Extent d. Persistence e. Control difficulties f. Other 3. All existing conditions and problems bearing upon the future should be forecast at this stage.
4, 5, & 6	Section VI Objectives Objectives should be clearly stated and based upon need to solve problems defined earlier. A jurisdiction might specify any of the following objectives to solve its solid wastes problems: 1. Provision of acceptable methods of waste disposal. 2. Acceptable collection and transportation methods 3. Development of better trained solid waste management personnel (operating and management levels) 4. Better informed public regarding solid waste problems and service requirements 5. Provision of sufficient legal & financial support for solid waste management 6. Development of solid waste management organizational structure 7. Other

Corresponding steps in the model	Elements of the Report
7 & 8	Section VII Recommendations for Action (The Plan)

1. This section should specify what and how the jurisdiction intends to accomplish in order to solve its solid waste management problems. It should include designation of the following:

   a. Timing and priorities of intended action (consider short- and long-term objectives)
   b. Location of intended action
   c. Who should act (i.e., agency, department)
   d. Estimated costs
   e. Problems that will be solved
   f. Other

2. It is suggested that the following aspects be considered as intended plan action. Proposals for this action should be accompanied by procedures for accomplishment and a schedule of initiation of this action.

   a. Rules, and regulations development
   b. Inspection and enforcement
   c. Licensing of facilities
   d. Training programs
   e. Technical assistance to operating units
   f. Design planning
   g. Site location
   h. Site acquisition
   i. Transfer station construction
   j. Incinerator construction
   k. Sanitary landfill construction
   l. Truck acquisition
   m. Reclamation station development
   n. Organizational formation
   o. Certification of operating personnel
   p. Public information and education program

Corresponding steps in the model	Elements of the Report
	q. Development of budgeting procedures, financing, cost-effectiveness, special charge features, and other operating management features r. Development of solid waste management operating departments and jurisdictions s. Recruitment, selection, and hiring of solid waste management operating personnel t. Other
8	Section VIII <u>Implementation (occurs outside the plan document but is guided by it)</u> A description of implementing activities is included in Part Five of this document.

Appendices (Last section of report)

This section of the report should include supporting materials and information used to develop the analyses, objectives, and plan. Content of this section might include:

a. Charts
b. Additional tables
c. References
d. Legislation and regulations
e. Definition of terms
f. Methodologies of research and analyses
g. Other

GENERAL REFERENCES

"Mandan, N. D. Tries Cold-Weather Operation of Sanitary Landfill," L. Weaver and D. Keagy, American City, Vol. 67, pp. 110-11, September 1952.

"Report on Investigation of the Leaching of Sanitary Landfill," California State Water Pollution Control Board, Publication No. 10, Sacramento, California, August 1954.

"A Sanitary Landfill in Your Community;"also "Sanitary Landfill Design," L. Weaver, Proceedings, Local Government Conference on Refuse Disposal Methods; University of Pittsburgh, April 22-23, 1954.

"Planned Refuse Disposal; A Report to the Directors of County Sanitation Districts of Los Angeles County, California," Los Angeles County, California, County Sanitation Districts, Joint Administrative Staff, 117 p., September 1955.

"Strip Mine Becomes Sanitary Fill in Tulsa," R. W. Ingalls, American City, Vol. 70, p. 11, January 1955.

"Investigation of Planned Refuse Collection and Disposal," American Society of Civil Engineers, proc. Journal of Sanitary Engineering Division, Vol. 82, 1014-1 to 1014-13, June 1956.

"Sanitary Refuse Fills in "Wet" Areas," C. A. Rogus, Public Works, Vol. 86, No. 12, December 1955.

"Burbank, California Fills Canyon to Gain Needed Land," American City, Vol. 72, No. 5, p. 144, May 1957.

"Municipal Refuse, A Low-Cost Resource: Sanitary Landfill to Construct Addition to Park," C. D. Smith, Public Works, Vol. 88, p. 94, July 1957.

"Sanitary Landfill Gas Control; Arlington, Massachusetts," R. Eliassen, et. al., American City, Vol. 72, pp. 115-17, December 1957.

"The Water Pollution Aspect of Refuse Disposal," J. Longwell, Institution of Civil Engineers, Proceedings, Vol. 8, p. 420, 1957.

"Effect of Earth Cover on Fly Emergence from Sanitary Landfills," R. J. Black and A. M. Barnes, Public Works, Vol. 89, pp. 91-4, February 1958.

"Planning is Key to Ames' Landfill Success," Refuse Removal Journal, Vol. 1, pp. 9-11, July 1958.

"Sanitary Fill Was a Campaign Promise; Belzoni, Mississippi," J. H. McBride, American City, Vol. 73, p. 38, November 1958.

"Use of Completed Sanitary Landfills," Casmir A. Rogus, Refuse Removal Journal, Vol. 2, No. 11: 10-11+ November 1959; and 1959 American Public Works Association Yearbook, p. 129.

"Safety Practices at Sanitary Landfills," L. W. Van Kleech, Public Works, Vol. 91, p. 156, April 1960.

"Cooperative Landfill - Park Project Combines Services of Seven Jurisdictions," Western City, Vol. 37, No. 7, p. 47, July 1961.

"Effects of Refuse Dumps on Ground Water Quality; California State," State Water Pollution Control Board, Publication No. 24, 1961.

"Metro Toronto Landfill Creates Many New Parks," Canadian Municipal Utilities Staff, Canadian Municipal Utilities, Vol. 99, No. 9, p. 28, September 1961.

"The Physical and Chemical Composition of Municipal Refuse," J. M. Bell, Project No. 2653-71-776; Summary of Chemical Analysis of Toledo Refuse Samples, Indiana, Purdue University, February 1961.

"Sanitary Landfill by Contract; Peoria, Illinois," American City, Vol. 76, pp. 104-5, February 1961.

"Muscatine Successfully Uses In-Town Landfills," Walter Pilgram, Refuse Removal Journal, Vol. 5, No. 10, p. 10, October 1962.

"Refuse Disposal Nedds and Practices in Northeastern Illinois," Technical Report No. 3, Northeastern Illinois; Metropolitan Area Planning Commission, June 1963.

"Seven New Jersey Communities Plan Joint Landfill Venture," Refuse Removal Journal, Vol. 6, No. 112, p. 28, December 1963.

"Ground Water Contamination in an Urban Environment," J. E. Hackett (Illinois State Geological Survey, Naperville, Ill.), Ground Water Vol. 3, No. 3, pp. 27-30, July 1965.

"Propose Train Haul to Desert Landfill," G. H. Hamlin, Refuse Removal Journal, Vol. 10, No. 3, p. 10, March 1967.

μσ 72-2-0017e